

VIII. PROCESS CONTROL OPTIONS

The major filter functions which require monitoring/control are head loss, influent and effluent quality (turbidity), flow rate through the filters, and backwash sequence, rate and duration. Filtration systems should be equipped with an influent and effluent turbidimeter, and head loss and flow indicators. Control of these parameters may be achieved through constant pressure filtration, constant-rate filtration (effluent rate control), and declining-rate filtration. Declining-rate filtration is usually the preferred method for control of granular media filters, but constant rate filtration may be preferred in the case of HTRW applications since there are not large flow variations. Generally, package filtration systems will have control systems already designed for the system. The designer will only need specify special needs different from the standard control system. Figure A-20 depicts typical schematics for several control systems.

In constant-pressure filtration, the total available pressure drop is applied across the filter throughout the filter run. The control mechanism is compressed gas maintained at a constant pressure. This maintenance of the total available pressure drop results in this constant pressure providing the driving force. Because the driving force stays constant, the flow will decrease as the filter bed becomes clogged with solids. Constant-pressure filtration is not often used.

Traditional constant-rate filtration is achieved by effluent rate control, in which the flow through the filter is maintained constant by adjusting the effluent flow rate valve. Control may be achieved directly or indirectly. Direct control is difficult since varying influent will greatly affect control needs. Indirect control is usually achieved by a set point controller linked to a pneumatic or hydraulic valve operator. Significant head may be lost in the controller. The plant flow is equally divided among the plant filters by means of a venturi and modulating butterfly valve. The venturi element communicates with the controller, which adjusts the butterfly valve to ensure that each filter is filtering an equal volume of the influent water. A level element is installed to signal when excessive head has built up and backwash must be initiated.

Influent flow splitting can achieve constant rate filtration by dividing the flow among filters via a flow splitting tank or channel. The water level over the filter is maintained at a constant level or is varied during the filter run. Influent flow splitting with constant level incorporates individual weirs in the header channel entrance to each filter. An element in each

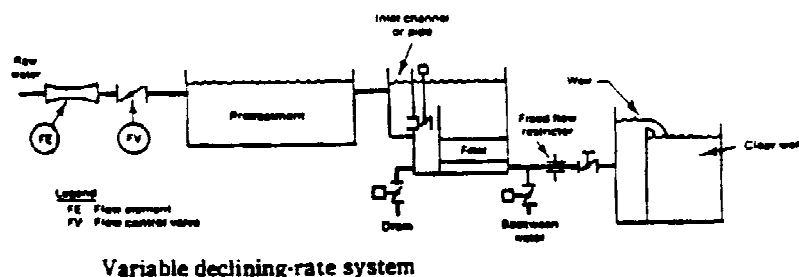
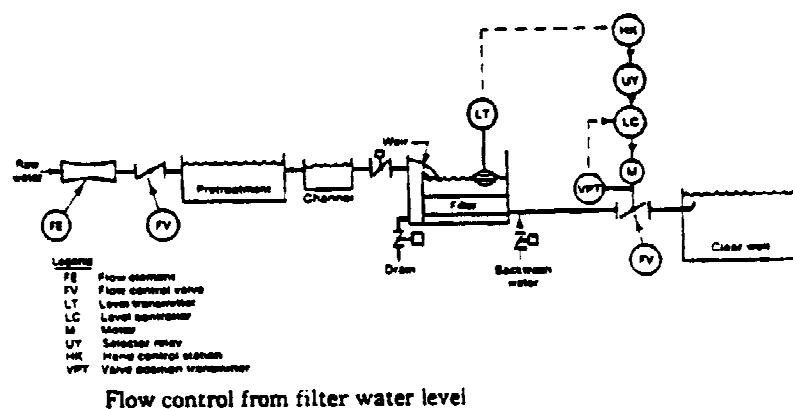
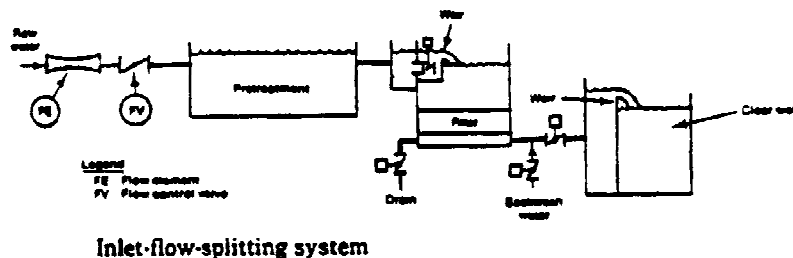
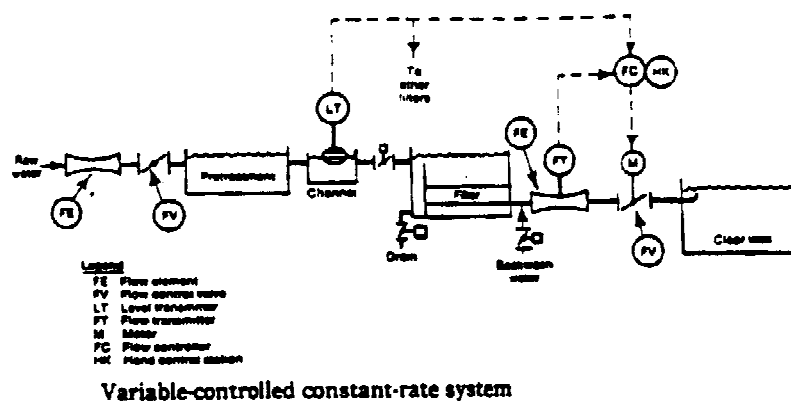


FIGURE A-20. TYPICAL CONTROL SYSTEM SCHEMATICS

filter communicates with a controller to keep the level of water over the media constant. This is accomplished with a modulating valve. No level elements, controllers, or modulating valves are necessary for influent flow splitting with varying water levels. After splitting, the water level is based upon the head loss through the filter. As the head loss increases, the water level increases to achieve a constant rate established by an orifice plate in the effluent piping. The splitting allows flow variations to be equally distributed among the filters. Often influent flow splitting may not be needed for low flow systems where the flow may be interrupted.

Variable-declining rate filtration controls the flow to the multiple filters by varying the upstream or downstream water level with centrifugal pumps. Each filter operates under the same head, but at different flow rates depending on degree of filter clogging. The influent enters below the low water level of the filters, resulting in less head loss. As one filter becomes clogged, the head loss builds, slowing the rate of filtration. The other filters pick up the capacity lost by the dirty filters. variable-declining rate filtration generally provides better effluent quality and higher unit filter run volumes.

Reference. See Appendix D.